

Fundamental Research at the

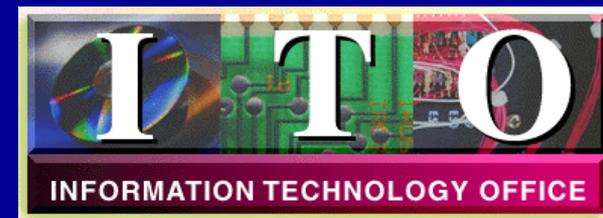
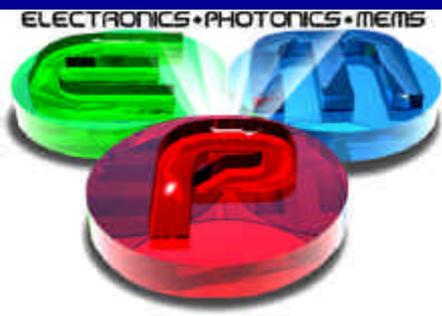


Interface

Abe Lee - MTO

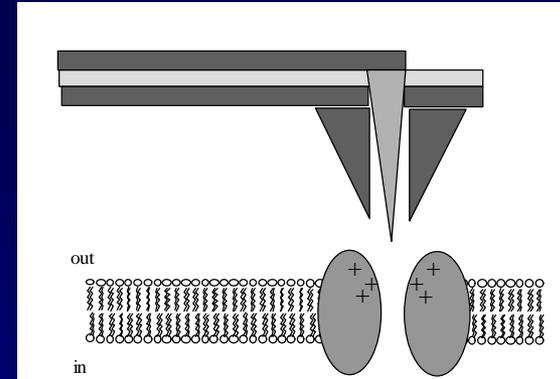
Eric Eisenstadt - DSO

Gary Strong - ITO



Deciphering and Interacting with Biology

- Interrogate and manipulate biological systems with modern physical devices
- Analyze, model, simulate & design with a new arsenal of math and computational tools



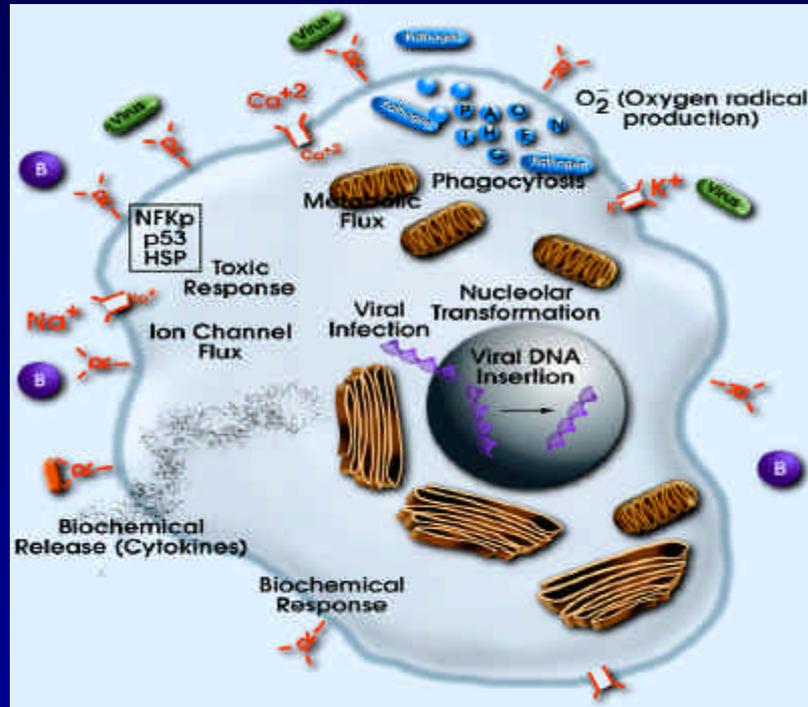
10 nm

$$S_{\text{unreg}} = f'_{\text{unreg}}(R^*) = -k_{\text{deg}}$$

$$S_{\text{auto}} = f'_{\text{auto}}(R^*) = -\frac{nk_p P k_1 a k_r}{(1 + k_p P + k_r R^*)^2} - k_{\text{deg}}$$



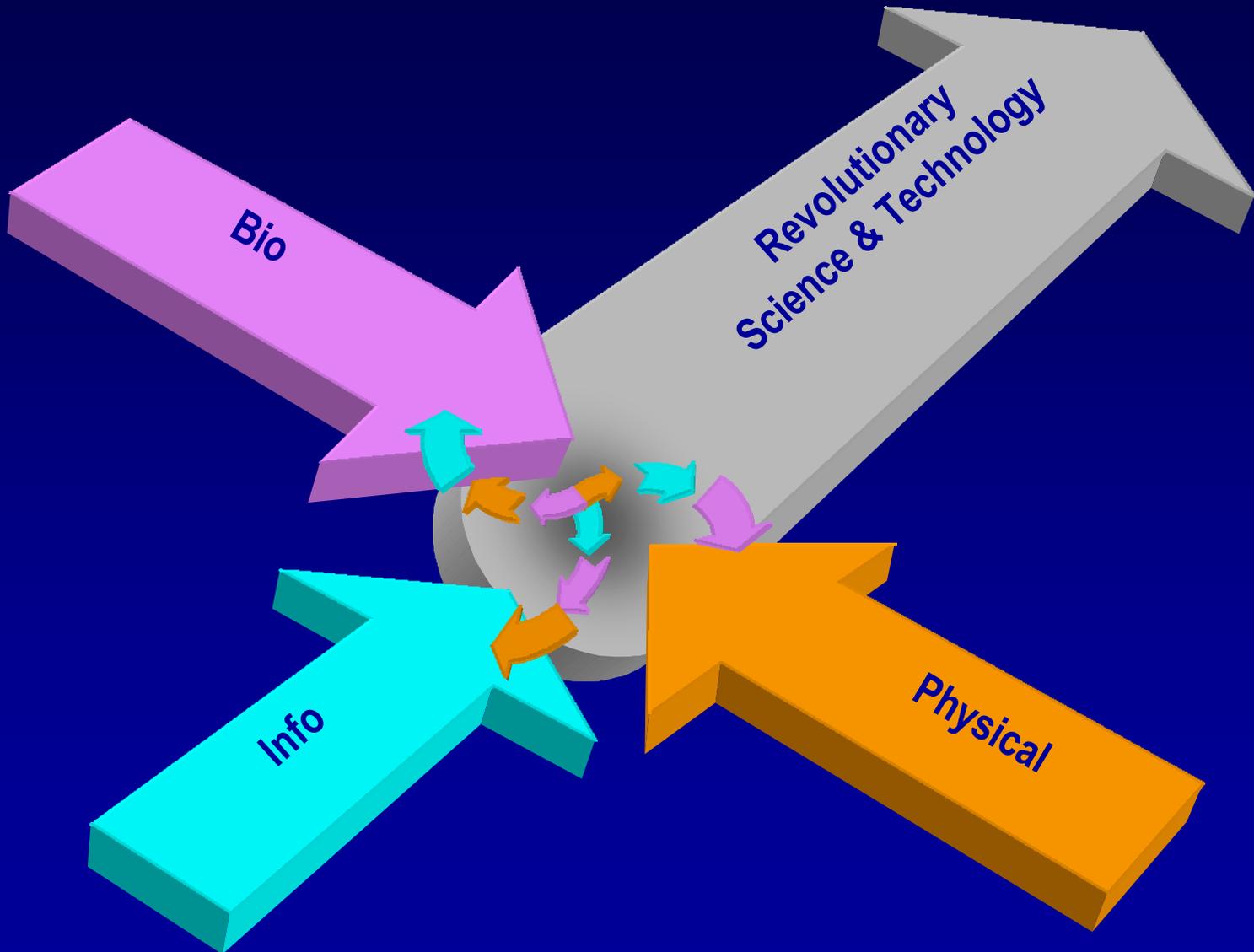
Biological Systems



~100 μ

- Specified by
 - 4×10^9 base pairs (2^{32})
 - 10^5 proteins (2^{17})
- Features
 - Regulation & adaptation
 - Hierarchical self-assembly
 - Repair and maintenance
 - Parallel processing
 - “Just-in-time” processes
 - Non-linear dynamics
 - Asynchronous control and signalling
 - Multicellular systems
 - Scalability

[Bio:Info:Physical]



- **Each discipline pushing and being pulled by the others**
- **Dynamic movement of students/postdocs among laboratories**
- **Regularly scheduled exchanges**
- **Interuniversity interactions**

What does success look like?

- **New points of departure for**
 - Research
 - Education
 - Institution
- **New breed of scientists fluent in three “languages”** (e.g. we applied a novel wavelet shrinkage my chimeric GFP with a device we designed and then manufactured with a DRIE)
- **New plateaus of understanding, e.g.**
 - New information about intracellular and neuronal signaling
 - New approaches to computation and representation of system dynamics, analog circuits
 - New approaches to making multifunctional nanodevices



Collaborative Opportunities

- **2 hr session on Thursday morning for awardees**
- **Organized by two major themes**
- **Freedom of movement to explore cross-theme interactions**
- **Chairperson(s) to report outcome to plenary session**